

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- 1 1. (currently amended) An image processing apparatus having
2 offset and optical black correction circuit coupled to receive
3 a control signal having a first and second phase and an
4 optical black signal from a charge coupled device, comprising:
 - 5 a. a first circuit to sample the optical black
6 signal at a predetermined reference voltage, the first circuit
7 comprises
 - 8 i. a correlated double sampler,
9 ii. a first and second programmable gain
10 amplifier, the first programmable gain amplifier coupled to
11 the correlated double sampler, [and]
12 iii. an adder coupled between the first and
13 second programmable gain amplifiers, [wherein the correction
14 circuit couples to the adder to add the positive and negative
15 difference to the optical black signal;] and
16 iv. an analog-to-digital converter coupled to
17 the second programmable gain amplifier for converting the
18 sampled signal into a digital signal;
 - 19 b. a second circuit to correct the optical black
20 offset coupled to the first circuit, wherein the second
21 circuit couples between the adder and the second programmable
22 gain amplifier to add the positive and negative difference to
23 the optical black signal, the second circuit comprises

24 i. a reverse programmable gain amplifier
25 coupled to the analog-to-digital converter to amplify the
26 optical black level of the digital signal; and
27 ii. an integrator coupled to the reverse
28 programmable gain amplifier to detect the optical black level
29 of the digital signal; wherein the integrator couples to the
30 adder.

1 2. (previously presented) The image processing apparatus as
2 recited in claim 1, wherein the first programmable gain
3 amplifier comprises

4 a first and second sampling circuit;
5 a differential amplifier having a first and second
6 input and a first and second output, the first sampling
7 circuit coupled to the first input, the second sampling
8 circuit coupled to the second input; and
9 a first and second feedback circuit, the first
10 feedback circuit coupled between the first input and the first
11 output, the second feedback circuit coupled between the second
12 input and the second output.

1 3. (previously presented) The image processing apparatus as
2 recited in claim 2, wherein the first sampling circuit
3 comprises

4 a first and second sampling switch;
5 a first sampling variable capacitor coupled to the
6 first sampling switch;
7 a second sampling capacitor coupled to the second
8 sampling switch;
9 a third feedback switch coupled between a power
10 supply providing a common-mode voltage for the image
11 processing apparatus and the first sampling variable
12 capacitor; and

13 a fourth feedback switch coupled between a power
14 supply providing a common-mode voltage for the image
15 processing apparatus and the second sampling capacitor.

1 4. (previously presented) The image processing apparatus as
2 recited in claim 3, wherein the first and second sampling
3 switch closes on the first phase of the control signal and
4 wherein the third and fourth sampling switch closes on the
5 second phase of the control signal.

1 5. (previously presented) The image processing apparatus as
2 recited in claim 3, wherein the second sampling circuit is
3 equivalent to the first sampling circuit.

1 6. (previously presented) The image processing apparatus as
2 recited in claim 2, wherein the first feedback circuit
3 comprises:

4 a first and second feedback switch coupled to a
5 power supply providing a common-mode voltage for the image
6 processing apparatus;

7 a feedback capacitor coupled between the first and
8 second feedback switches; and

9 a third feedback switch coupled between the feedback
10 capacitor and the first output node of the amplifier, wherein
11 the first output of the differential amplifier couples to the
12 adder.

1 7. (previously presented) The image processing apparatus as
2 recited in claim 6, wherein the first and second sampling
3 switch closes on the first phase of the control signal,
4 wherein the third sampling switch closes on the second phase
5 of the control signal.

1 8. (previously presented) The image processing apparatus as
2 recited in claim 6, wherein the second feedback circuit is
3 equivalent to the first feedback circuit.

1 9. (previously presented) The image processing apparatus as
2 recited in claim 1, wherein the first programmable gain
3 amplifier comprises:

4 a sampling circuit;
5 an amplifier having an input and an output, the
6 sampling circuit coupled to the input; and
7 a feedback circuit coupled between the input and the
8 output.

1 10. (previously presented) The image processing apparatus as
2 recited in claim 9, wherein the sampling circuit comprises:

3 a first and second sampling switch;
4 a first sampling variable capacitor coupled to the
5 first sampling switch;
6 a second sampling capacitor coupled to the second
7 sampling switch;
8 a third feedback switch coupled between a power
9 supply providing a common-mode voltage for the image
10 processing apparatus and the first sampling variable
11 capacitor; and
12 a fourth feedback switch coupled between a power
13 supply providing a common-mode voltage for the image
14 processing apparatus and the second sampling capacitor.

1 11. (previously presented) The image processing apparatus as
2 recited in claim 10, wherein the first and second sampling
3 switch closes on the first phase of the control signal and
4 wherein the third and fourth sampling switch closes on the
5 second phase of the control signal.

1 12. (previously presented) The image processing apparatus as
2 recited in claim 9, wherein the feedback circuit comprises:
3 a first and second feedback switch coupled to a
4 power supply providing a common-mode voltage for the image
5 processing apparatus;
6 a feedback capacitor coupled between the first and
7 second feedback switches; and
8 a third feedback switch coupled between the feedback
9 capacitor and the first output node of the amplifier, wherein
10 the first output of the differential amplifier couples to the
11 adder.

1 13. (previously presented) The image processing apparatus as
2 recited in claim 12, wherein the first and second sampling
3 switch closes on the first phase of the control signal,
4 wherein the third sampling switch closes on the second phase
5 of the control signal.

1 14.(currently amended) The image processing apparatus as
2 recited in claim 1, wherein the second programmable gain
3 amplifier comprises:
4 a first and second sampling circuit;
5 a differential amplifier having a first and second
6 input and a first and second output, the first sampling
7 circuit coupled to the first input, the second sampling
8 circuit coupled to the second input; and
9 a first and second feedback circuit, the first
10 feedback circuit coupled between the first input and the first
11 output, the second feedback circuit coupled between the second
12 input and the second output.

1 15. (previously presented) The image processing apparatus as
2 recited in claim 14, wherein the first sampling circuit
3 comprises:

4 a first sampling switch;

5 a sampling variable capacitor coupled to the first
6 sampling switch; and

7 a second sampling switch coupled between the
8 sampling variable capacitor and a power supply providing a
9 common-mode voltage for the image processing apparatus.

1 16. (previously presented) The image processing apparatus as
2 recited in claim 15, wherein the first sampling switch closes
3 on the second phase of the control signal and the second
4 sampling switch closes on the first phase of the control
5 signal.

1 17. (previously presented) The image processing apparatus as
2 recited in claim 14, wherein the second sampling circuit is
3 equivalent to the first sampling circuit.

1 18. (previously presented) The image processing apparatus as
2 recited in claim 14, wherein the first feedback circuit
3 comprises:

4 a first and second feedback switch coupled to a
5 power supply providing a common-mode voltage for the image
6 processing apparatus;

7 a feedback capacitor coupled between the first and
8 second feedback switches; and

9 a third feedback switch coupled between the feedback
10 capacitor and the first output node of the amplifier, wherein
11 the first output of the differential amplifier couples to the
12 adder.

1 19. (currently amended) The image processing apparatus as
2 recited in claim 18 [14], wherein the first and second
3 [sampling] feedback switch closes on the first phase of the
4 control signal, wherein the third [sampling] feedback switch
5 closes on the second phase of the control signal.

1 20. (previously presented) The image processing apparatus as
2 recited in claim 14, wherein the second feedback circuit is
3 equivalent to the first feedback circuit.

1 21. (previously presented) The image processing apparatus as
2 recited in claim 1, wherein the second programmable gain
3 amplifier comprises:
4 a sampling circuit;
5 an amplifier having an input and an output, the
6 sampling circuit coupled to the input; and
7 a feedback circuit coupled between the input and the
8 output.

1 22. (previously presented) The image processing apparatus as
2 recited in claim 21, wherein the sampling circuit comprises:
3 a sampling switch; and
4 a first sampling variable capacitor coupled to the
5 first sampling switch.

1 23. (previously presented) The image processing apparatus as
2 recited in claim 22, wherein the sampling switch closes on the
3 second phase of the control signal.

1 24. The image processing apparatus as recited in claim
2 21, wherein the feedback circuit comprises:

3 a first and second feedback switch coupled to a
4 power supply providing a common-mode voltage for the image
5 processing apparatus;
6 a feedback capacitor coupled between the first and
7 second feedback switches; and
8 a third feedback switch coupled between the feedback
9 capacitor and the first output node of the amplifier, wherein
10 the first output of the differential amplifier couples to the
11 adder.

1 25. (previously presented) The image processing apparatus as
2 recited in claim 24, wherein the first and second sampling
3 switch closes on the first phase of the control signal,
4 wherein the third sampling switch closes on the second phase
5 of the control signal.

1 26. (currently amended) An image processing apparatus having
2 offset and optical black correction circuit coupled to receive
3 a control signal having a first and second phase and an
4 optical black signal from a charge coupled device, comprising:
5 a first circuit to sample the optical black signal
6 at a predetermined reference voltage, the first circuit
7 comprises:
8 a correlated double sampler,
9 a first and second programmable gain amplifier,
10 the first programmable gain amplifier coupled to the
11 correlated double sampler, and
12 an adder coupled between the first and second
13 programmable gain amplifiers, wherein the correction
14 circuit couples to the adder to add the positive and
15 negative difference to the optical black signal;

16 an analog-to-digital converter coupled to the second
17 programmable gain amplifier for converting the sampled signal
18 into a digital signal; and
19 a second circuit to correct the optical black offset
20 coupled to the first circuit, the second circuit comprises:
21 a first and second sampling circuit, [;]
22 a differential amplifier having a first and
23 second input and a first and second output, the first
24 sampling circuit coupled to the first input, the second
25 sampling circuit coupled to the second input, [;] and
26 a first and second feedback circuit, the first
27 feedback circuit coupled between the first input and the
28 first output, the second feedback circuit coupled between
29 the second input and the second output.

1 27. (previously presented) The image processing apparatus as
2 recited in claim 26, wherein the first sampling circuit
3 comprises:
4 a first and second sampling switch, the first
5 sampling switch coupled to a power supply providing a common-
6 mode voltage for the image processing apparatus, second
7 sampling switch coupled to a predetermined optical black
8 value;
9 a third and fourth sampling switch; and
10 a sampling variable capacitor having a first and
11 second end, the first and third sampling switches coupled to
12 the first end of the sampling variable capacitor, the second
13 and fourth switch coupled to the second end of the sampling
14 variable capacitor.

1 28. (previously presented) The image processing apparatus as
2 recited in claim 27, wherein the first and fourth sampling
3 switch closes on the first phase of the control signal,

4 wherein the second and third sampling switch closes on the
5 second phase of the control signal.

1 29. (previously presented) The image processing apparatus as
2 recited in claim 26, wherein the second sampling circuit is
3 equivalent to the first sampling circuit.

1 30. (previously presented) The image processing apparatus as
2 recited in claim 26, wherein the first feedback circuit
3 comprises:
4 a feedback capacitor.

1 31. (previously presented) The image processing apparatus as
2 recited in claim 30, wherein the second feedback circuit is
3 equivalent to the first feedback circuit.

1 32. (previously presented) An image processing apparatus
2 having offset and optical black correction circuit coupled to
3 receive a control signal having a first and second phase and
4 an optical black signal from a charge coupled device,
5 comprising:
6 a first circuit to sample the optical black signal
7 at a predetermined reference voltage, the first circuit
8 comprises
9 a correlated double sampler,
10 a first and second programmable gain amplifier,
11 the first programmable gain amplifier coupled to the
12 correlated double sampler, and
13 an adder coupled between the first and second
14 programmable gain amplifiers, wherein the correction circuit
15 couples to the adder to add the positive and negative
16 difference to the optical black signal;

17 an analog-to-digital converter coupled to the second
18 programmable gain amplifier for converting the sampled signal
19 into a digital signal;

20 a second circuit coupled to the first circuit to
21 correct the optical black offset, the second circuit
22 comprises:

23 a sampling circuit;

24 an amplifier having an input and an output, the
25 sampling circuit coupled to the input; and

26 a feedback circuit coupled between the input
27 and the output, the feedback circuit coupled to the adder.

1 33. (previously presented) The image processing apparatus as
2 recited in claim 32, wherein the sampling circuit comprises:

3 a first and second sampling switch, the first
4 sampling switch coupled to a power supply providing a common-
5 mode voltage for the image processing apparatus, second
6 sampling switch coupled to a predetermined optical black
7 value;

8 a third and fourth sampling switch; and

9 a sampling variable capacitor having a first and
10 second end, the first and third sampling switches coupled to
11 the first end of the sampling variable capacitor, the second
12 and fourth switch coupled to the second end of the sampling
13 variable capacitor.

1 34. (previously presented) The image processing
2 apparatus as recited in claim 33, wherein the first and fourth
3 sampling switch closes on the first phase of the control
4 signal, wherein the second and third sampling switch closes on
5 the second phase of the control signal.

1 35. (previously presented) The image processing
2 apparatus as recited in claim 32, wherein the feedback circuit
3 comprises a feedback capacitor.

1 36. (previously presented) An image processing method
2 comprising the steps of:
3 converting a signal of reflected light off of an
4 object photoelectrically to obtain an optical black signal;
5 generating a predetermined reference voltage;
6 clamping the optical black signal to a predetermined
7 reference voltage;
8 amplifying the optical black signal by a first gain
9 of a first programmable gain amplifier;
10 amplifying the optical black signal by a second gain
11 of a second programmable gain amplifier;
12 feeding back the amplified signal to a reverse
13 programmable gain amplifier;
14 amplifying the optical black signal by the inverse
15 of the second gain; and
16 adding the amplified optical black signal to the
17 optical black signal after the first programmable gain
18 amplifier.

Amendments to the Drawings:

The attached sheet of drawings includes changes to Figure 1.
5 This sheet which includes Figure 1 replaces the original sheet
including Figure 1.

Attachment: Replacement Sheet
10 Annotated Sheet Showing Changes